# Artificial Neural Networks

2nd Assginment - Shahid Beheshti University - Bachelor's Program

November 11, 2022

I hope all is well with you. This is the second series of homework for the Artificial Neural Networks course. The deadline for this assignment is **due date November 22, Tuesday**. All students are expected to submit their homework on time. Feel free to **ask questions regarding the exercises in the course Telegram group** if needed. As part of your assignment, you are required to write a detailed report.

## Exercise 1

Describe the backpropagation details in the convolutional layers. (For a better understanding, check out this link: https://www.jefkine.com/general/2016/09/05/backpropagation-in-convolutional-neural-networks/)

## Exercise 2

What is the symmetry breaking phenomenon in artificial neural networks? What can be done to prevent this from happening?

## Exercise 3

What are the benefits of the pooling layers? What are the drawbacks of the pooling layers? Are you willing to use these layers? Can you use these layers frequently?

## Exercise 4

Please describe the differences between the cross-entropy vs. quadratic cost. Which one do you prefer for the classification problem?

## Exercise 5

There is an alternative activation function for ReLU called leaky ReLU. I would like you to compare them.

- Which one is faster?
- Which one can prevent gradient vanishing, and how?

# Exercise 6

In this part, you will implement a convolutional neural network to solve an imagery classification problem. You have to work with the CIFAR-10 dataset, which consists of 10 classes with 50,000 examples in the training set and 10,000 examples in the test set.


- Report the depth effect of different hidden layers.
- Use batch normalization for convolution layers and report its effects.
- Use different architectures to find the optimum model for achieving maximum accuracy.
- The confusion matrix should be calculated and analyzed for your model.